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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PS 1953 for a patent by VERTECH HUME PTY LTD as filed on 26 April 2002.

WITNESS my hand this
Eighth day of May 2003

J. Billingsley

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AUSTRALIA
Patents Act 1990

PROVISIONAL SPECIFICATION

PS filed 26th April 2002

Invention Title : **Vertical Moulding of Concrete**

Applicant: **Vertech Hume Pty Ltd** [A C N 096 468 405]

Inventors: **Graeme Reginald Hume**

The invention is described in the following statement:

VERTICAL MOULDING OF CONCRETE

This invention relates to improvements in the moulding of concrete articles such as poles, piles or pipes in a vertical mould.

Background to the invention

The moulding of concrete pipes, hollow poles or piles in a vertical mould has been proposed in USA patent 4996013. The mould is filled from the bottom and the concrete is compressed between an inner and outer mould by moving the inner mould outwardly using a flexible membrane. Water drained from the concrete into drainage galleries or tubes in the membrane. Because water segregates from the concrete during the filling of the mould water tended to accumulate in the upper section of the mould during filling. This problem was addressed in USA patent 6284172 by capping the end of the mould to allow egress of fluid but retain particulates and stopping the filling of the mould when the presence of solid materials at the end cap is sensed.

Although these methods produce poles of adequate strength the surface finish of the articles is sometimes rough and cavities form in the surface during stripping of the article from the mould.

It is an object of this invention to overcome these problems and provide a method and apparatus that produces poles, piles or pipes in a vertical mould with an acceptable surface finish.

Brief Description of the Invention

To this end the present invention provides a method of forming concrete articles in a vertical mould in which the concrete mix is pumped into the mould from the bottom of the mould and the segregation of the water is inhibited to maintain an homogenous viscosity as the concrete mix rises in the mould.

This invention is partly predicated on the discovery that surface defects are caused by segregation of the water during pumping allowing localized regions to develop lower water to concrete ratios than for the composition as a whole. It was discovered that segregation occurs because water escapes through the drainage galleries or tubes in the flexible mould liners before the mould is filled.

Accordingly the present invention provides a method of moulding long concrete articles in a vertical mould which incorporates a mould liner having drainage tubes used to dewater the concrete when the mould is filled, the improvement being to close off the drainage tubes during the filling of the mould to inhibit water loss in the concrete during filling.

In another aspect the present invention provides a flexible mould liner incorporating drainage tubes to allow dewatering of the concrete wherein the drainage tubes are at least partially closed during the filling of the mould to inhibit water loss and are opened when the mould is filled.

The closing of the drainage tubes can be achieved in any suitable way. One way valves which prevent water from rising in the drainage tubes to a height not much greater than the level of concrete in the mould can be used. It has been found that one way valves situated at vertical spacings of 300mm are adequate but spacings of 100mm are preferred.

Another alternative is to use a thin flexible inner tube in side the drainage tubes which inner tube can be pressurized with air or fluid to press against the openings in the drainage tubes to prevent water escaping from the concrete. When the inner tube is depresssurised water can escape to allow dewatering of the concrete in the filled mould.

It is also possible to utilize water pressure from the mould filling to pressurize the inner tube in the drainage tube. This can be done by closing off the upper end of the inner tube or having a one way valve at that end and having a drainage cock at the lower end. This means a slightly greater pressure is need to lift the concrete and some water loss occurs but the homogenous viscosity of the concrete is maintained.

Detailed description of the invention

Preferred embodiment of the invention is described with reference to the drawings in which:

Figure 1 is a schematic illustration of a first embodiment of the drainage tube of this invention;

Figure 2 is a schematic illustration of a second embodiment of the drainage tube of this invention;

Figure 3 is a schematic illustration of a third embodiment of the drainage tube of this invention;

Figures 4 and 5 is a schematic illustration of the mould and mould liners utilizing the drainage tubes of this invention.

The vertical mould for forming concrete poles is of the kind described in USA patent 6284172 the contents of which are incorporated herein by reference. The difference is that the drainage tubes in the filter media of the mould liner are modified in accordance with this invention. The mould is usually 12.5 metres high and concrete in a water/cement ration Of about 0.45 is pumped into the bottom of the mould. Once the concrete comes into contact with the the filter media water begins to bleed into the drainage holes which are usually spaced at 50mm centres. The pressure required to raise the concrete 12.5 metres is 120 psi whereas the pressure of a 12.5 metre head of water is 20psi with the result that the water is forced into the drainage tubes. The water loss is usually not homogenous and some portions of the concrete lose more water than others. To control and inhibit this water loss the drainage tubes of this invention are used. In figure 1 a first embodiment uses nylon drainage tubes 5 incorporated into the filter media 4 which have drainage holes 6 at 50mm centres. Inside the drainage tube 5 is a silicon tube 15 which is able to be filled with water or air under pressure to seal against the holes 6 in the tube 5. The fluid is introduced into the inner tube 15 via the inlet 16 and the remote end 17 is sealed or tied.

An alternative arrangement is shown in figure 2 where the drainage tube 5 includes non return valves spaced vertically 100mm apart. The non return valves may consist of a valve seat comprising an annular brass valve seat 10 glued to the internal wall of the drainage tube 5 and a floating ball 9 adapted to seal against the valve seat and supported on a helical support 11 which in turn is supported on the upper face of the valve seat located 100mm below.

As concrete rises in the mould water enters the drainage tube and because the drainage cock 7 [figure 4] is closed the water rises vertically in the drainage tube 5. Initially water will rise to drain hole 8 and some will escape into the mould space until the concrete reaches the level of hole 8. the water rising in the drainage tube 5 will press the ball 9 against valve seat 10 and prevent further water entering the drainage tube 5 until the concrete level rises to the level of the

drainage hole immediately above the valve seat 10. In this way the water loss from the concrete is inhibited to the volume of the drainage tubes in the 100mm rise of the mould between valve seats. When the mould is filled the drainage cock 7 is opened and the dewatering procedure as outlined in USA patent 6284172 is followed.

A further embodiment is illustrated in figures 3 and 4 where the mould cavity 2 includes a reinforcing cage of steel 3 around which the concrete is pumped. As the concrete enters the mould 2 the water passes through the filter 4 and then into the drainage tube 5 via the drainage holes 6. The drainage cock 7 is closed so that the water rises up the tube 5. Inside the drainage tube is an inner tube 12 which has a non return, floating ball valve 13 at its upper end adjacent the top of the mould cavity. As water rises in the tube 12 it pushes out the air and when the water reaches the non return valve the valve is closed and the pressure inside tube 12 increases. The water level in the tube 12 is always higher than the concrete level in the mould cavity and the higher pressure in the tube 12 presses the tube 12 against the drainage tube and prevents water entering the tube 5 through the drain holes 14. When the mould cavity 2 is filled the drain cock 7 is opened and the water in tube 12 flows out. When the dewatering procedure commences the pressure of the water in the mould is greater than the pressure within the empty drain tube 12 so that it collapses and allows water to enter tube 5 through the holes 14 and drain away.

Those skilled in the art of moulding concrete articles will realize that the present invention can be put into effect by a variety of means to inhibit water escaping the mould cavity during the filling of the mould cavity as well as the methods and arrangements disclosed herein.

CLAIMS

1. A method of forming concrete articles in a vertical mould in which the concrete mix is pumped into the mould from the bottom of the mould and the segregation of the water is inhibited to maintain an homogenous viscosity as the concrete mix rises in the mould.
2. A flexible mould liner incorporating drainage tubes to allow dewatering of the concrete wherein the drainage tubes are at least partially closed during the filling of the mould to inhibit water loss and are opened when the mould is filled.
3. A mould liner as claimed in claim 2 in which the drainage tubes incorporate an inner tube that is pressurized to close off the drainage holes in the walls of the drainage tube.
4. A mould liner as claimed in claim 2 in which the drainage tubes incorporate one way valves vertically spaced apart in the drainage tube.

ABSTRACT

A method of moulding long concrete articles in a vertical mould which incorporates a mould liner with drainage tubes used to dewater the concrete when the mould is filled. The improvement is to close off the drainage tubes during the filling of the mould to inhibit water loss in the concrete during filling. The drainage tubes may incorporate one way valves or include inner tubes that may be pressurized to inhibit water entering the drainage tube.

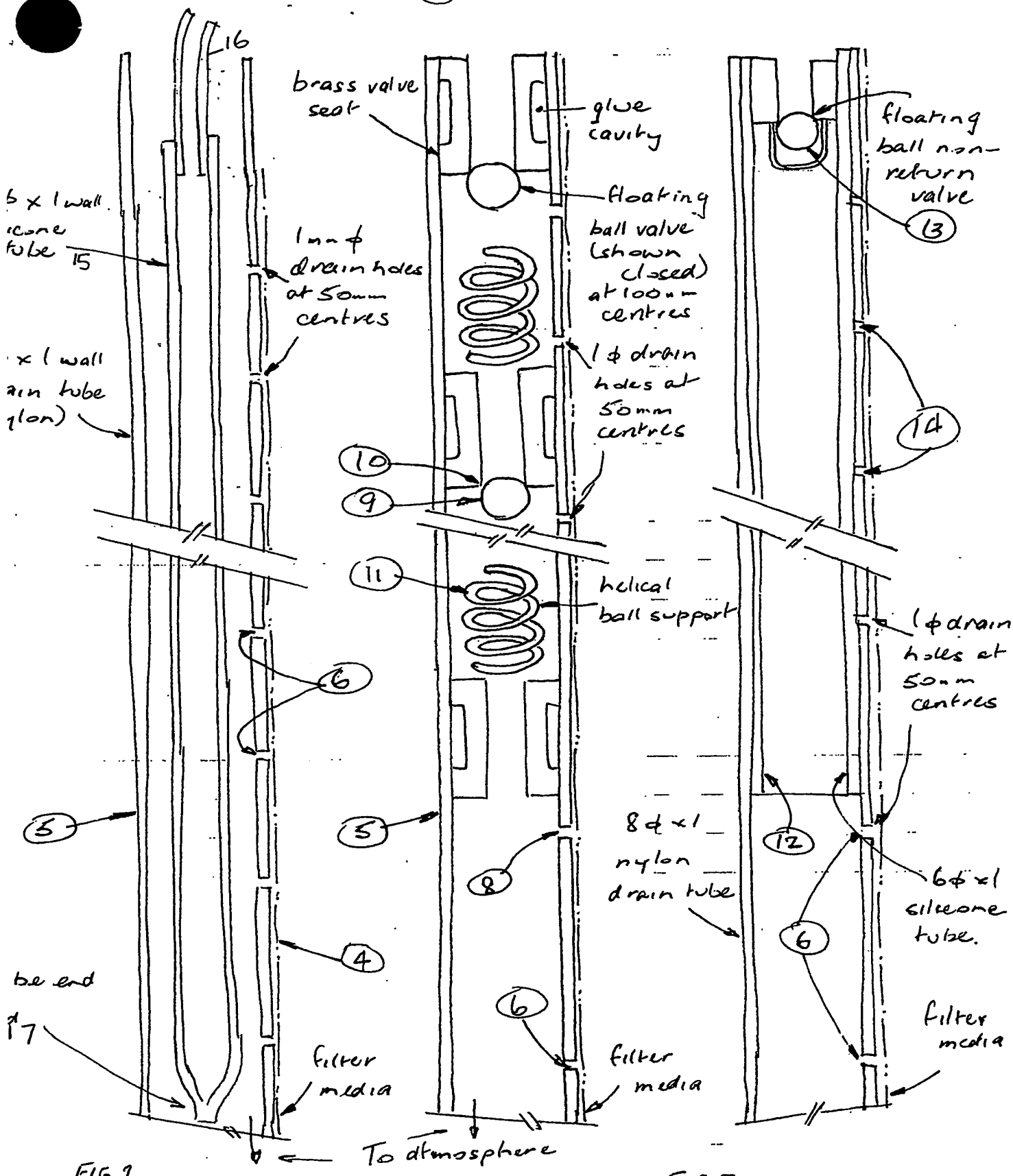


FIG 1

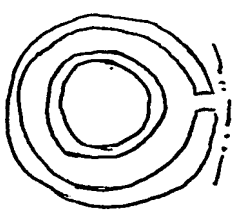


FIG 2

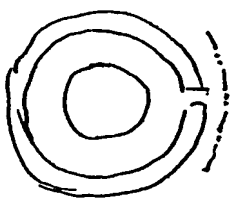
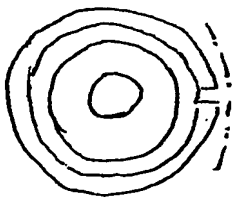


FIG 3



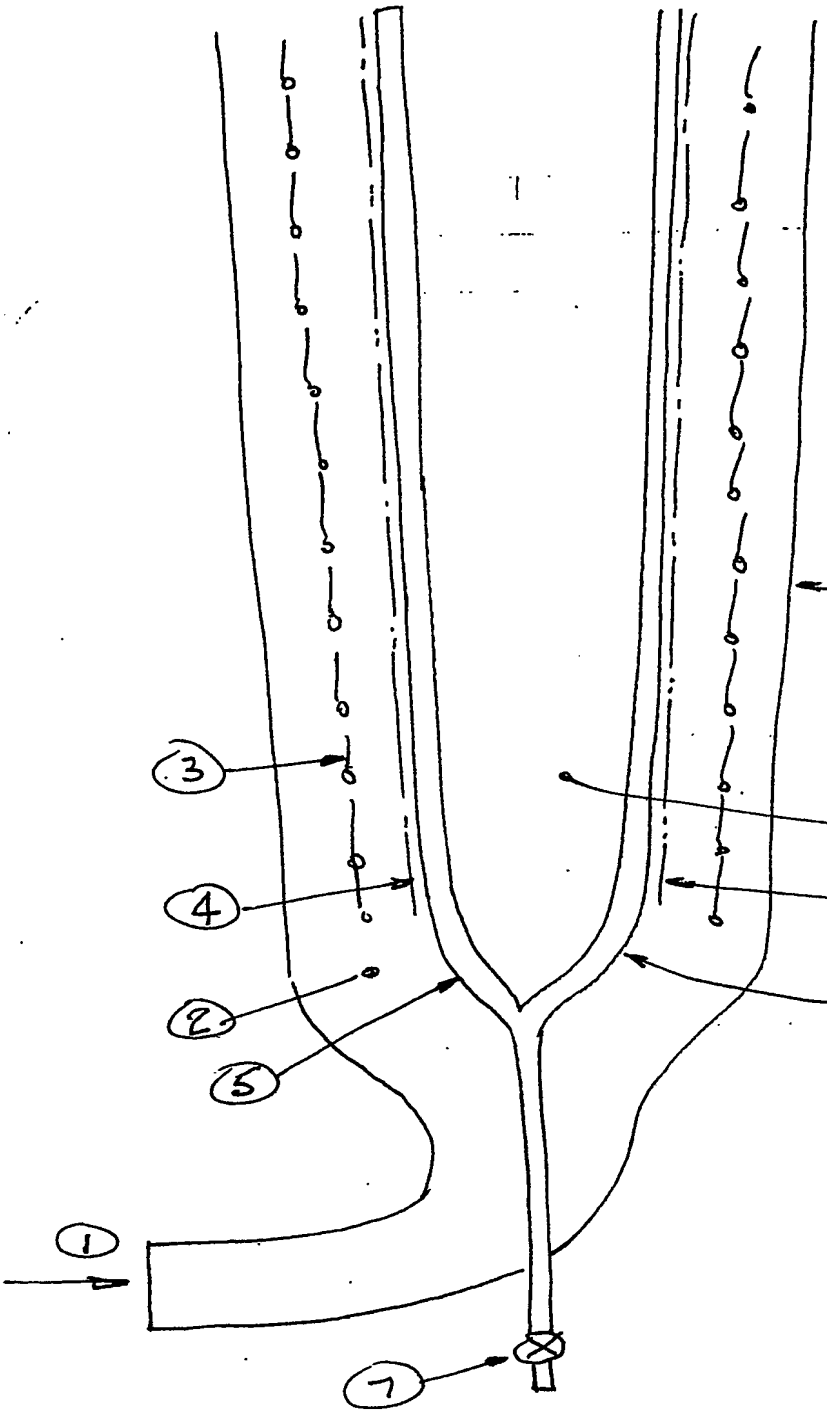


FIG. 4.